2005

Integrating Journal Writing With Inquiry Based Science Instruction In A Second Grade Classroom

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INTEGRATING JOURNAL WRITING WITH INQUIRY BASED SCIENCE INSTRUCTION IN A SECOND GRADE CLASSROOM

by

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B.S. University of Central Florida, 2000

A thesis submitted in partial fulfillment of the requirements for the degree of Master of Education from the Department of Teaching and Learning Principles in the College of Education at the University of Central Florida
Orlando, Florida

Spring Term
2005

ABSTRACT

This action research study investigated the effects of using science journals to promote science writing and to investigate changes in student attitudes in a second grade inquiry-based science class. This was an action research study in which qualitative and quantitative data was collected. The data was collected using science journals, pre and post inventories, field notes, teacher observations, videotaped science inquiry lessons, and surveys. The students demonstrated a true fondness for journal writing and expressed interest in continued use. After concluding this action research study, I better understand the benefits of utilizing journal writing to enhance my teaching of the science curriculum as well as the other disciplines I facilitate.

This thesis is dedicated to my husband David. Thank you for all of your love and support during these past two years of the program- and our first year of marriage!

ACKNOWLEDGMENTS

During the past two years of graduate school there were a few people that impacted my life. I would not have been able to complete this program without these truly amazing people. This has been an experience that I will never forget and will always treasure!

I would like to thank my husband again for supporting me whole-heartedly during this entire process. He was there for me and encouraged me even when I was not sure if I could reach my goal. Because of his love and support, he inspired me to keep going and never give up.

I would like to thank Colleen for our blond moments and our new friendship.

I would like to thank Dr. Nancy Lewis for all your help and support during this tedious process.

I would like to thank Debbie Rivera for all of her technical advice.

I would also like to thank my second grade class because without them I would not have been able to complete this action research project. I am very proud of them!

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CHAPTER ONE: INTRODUCTION

One of my major goals as a teacher is teaching science in a way that my second graders can both comprehend the information and be able to synthesize the information they have learned into future lessons. Most science students perform experiments, use the scientific method to draw hypothesis and study results, and generally use empirical knowledge to learn the subject. My goal is, by using journal writing, to introduce my students to the science skill set from another avenue. I believe that students can and will learn more about science by writing and discussing their findings. Giving students the opportunity to write about what they are learning helps them to remember and understand their emerging knowledge. I believe journals allow the students to process the content that is encountered, supporting them to think about their experiences more deeply.

I have observed that writing seems to be a difficult skill for my young students. I firmly believe that the more a skill is practiced, the better one becomes at that skill. Therefore, if I increase my students' opportunities to write across the content areas, then students should develop as writers. In addition, my students should develop an increased interest in science because of the journal writing. One of my goals is to measure, through

attitudinal surveys, the increase in positive attitudes that my students demonstrate through the course of my study. My goal is for my students to develop understanding of science content while growing as writers.

My hope was that integrating journal writing in science would provide me with immediate feedback on my students' comprehension of the lessons and concepts I taught. "These journals provide an opportunity to access and assess changes in children's understandings and thinking, identify misconceptions, and provide a more complex picture of children's understandings of science phenomena" (Shepardson & Britsch, 1997, p.13). In addition, student responses will help me gain insights into the effectiveness of my instructional techniques and help guide my future planning.

Purpose

The purpose of this action research study was to examine the effects of my teaching practices associated with science journals on my second grade students' scientific literacy, their attitudes toward science, and their ability to perform scientific inquiry.

Research Questions

How will using science journals in the primary classroom affect students' inquiry skills?

How will using science journals affect the student's attitudes towards learning science?

How will using science journals enhance student scientific writing?

Definitions

Exploratory Journals - Notebooks used to record data and respond to activities and lessons.

Integrated Curriculum - Curriculum that teaches multiple content areas simultaneously.

Scientific Literacy - Means that a person can ask, find, or determine answers to questions derived from curiosity derived from everyday experiences (National Science Education Standards, 1996, p.23).

Intern - A college student assigned by their university to teach in a classroom guided by an experienced teacher preparing them for their own classroom in the future.

Inquiry - Scientific inquiry refers to the diverse ways in which scientists study the natural world and propose explanations based on the evidence derived from their work. Inquiry also refers to the activities of students in which they develop

knowledge and understanding of scientific ideas, as well as an understanding of how scientists study the natural world (National Science Education Standards, 1996, p.23).

Limitations

I conducted my action research study with my second grade class. This study had the following limitations.

1. It was a convenience sample because it was my class of students.
2. At second grade age, the students were novice writers as well as readers. The writing ability of several of my students was below grade level. Several of my students worked on the basic mechanics of writing.
3. There was a senior intern teaching my class during the beginning of my data collection period. Therefore, instruction was delivered by her for four weeks and by me for six weeks during the study.
4. Journal writing was limited due to unexpected school closings during my data collection period.

Significance of the Study

There is a broad body of research that documents the benefits of journal writing in the science classroom (Shepardson

and Britsch, 2000; Reardon, 2002; Harmelink, 1998; Rowe, 1973; National Research Council's Science Education Standards 1996). Shepardson and Britsch (2000) found that writing in science has the potential to assist children in science comprehension. By using journal writing in the science curriculum, students are encouraged to generate their own thoughts and ideas about science concepts. Shepardson and Britsch (2000) state the importance of science journal writing in a first and second grade science study on earth materials. In this three day study of sixteen first and second graders, the children first explored physical attributes and properties of five earth materials: clay, silt, sand, pebbles, and gravel. The students conducted several investigations during the study. In all of the activities the students were consistently writing in their science journals. The majority of students, in this study, used their science journals to represent either the science materials or the physical activity itself. Shepardson and Britsch found that children could represent their experiences, understandings, and language in the journals. "Their understanding was characterized by a simple recording of what happened in the activity" (p.4).

Reardon (2002) suggests that writing in science does more than provide a record of investigations and a way of collecting

data for analysis and interpretation. “Writing is a way into thinking in science” (p.86). Her students kept a scientist’s notebook to record observations, data, and questions or inquiries that the students would like to further explore. Reardon (2002) further states that:

> Writing is the way we think, organize, reflect, plan, and solve problems. Writing holds our thinking still so we can revisit, rethink, and revise our plans, our conceptual understandings, our explanations, our theories. Writing does all that and more- it puts us in touch with the beauty of science (p.99).

There is also research about the benefits of teaching science using the inquiry method. Carin and Bass (2001), Llewellyn (2002), and the National Research Council’s Science Education Standards (1996), shows that students can effectively learn science through inquiry. In the process of inquiry, learners work together within a classroom atmosphere of collaboration, cooperation, and respect. Carin and Bass (2001) explain that “teachers share in and facilitate this process, guiding children as they ask questions, conduct investigations, and connect observational evidence and scientific knowledge to explain interesting phenomena” (p.105).

Llewellyn (2002) found that “success in learning science can best take place when the students are actively and thoughtfully immersed in the learning process” (p.27). Llewellyn’s study of a fourth grade class’s science inquiry lesson about properties of ice provided the students with opportunities to generate more questions to investigate. In this study, the students wrote in their science journals about what they were doing and what was happening during their investigations. The teacher later used the students’ science journals as a way of assessing their progress on writing and note taking. “This inquiry investigation certainly aroused the students’ interests and curiosity about ice. Now they are more apt to investigate and discover on their own because the students were genuinely engaged in the subject” (p.25).

The National Science Board (2000) explains how students and teachers can use inquiry to learn how to do science, learn about the nature of science, and learn science content by becoming scientifically literate. The 1996 National Science Education Standards discuss the importance of teaching inquiry in science. “Students who use inquiry to learn science engage in many of the same activities and thinking processes as scientists who are seeking to expand human knowledge of the natural world (1996, p.1).

According to the National Science Board (1996), scientific literacy has become a necessity for everyone. Everyone needs to use scientific information to make choices that arise everyday (p.1). The National Research Council (NRC) released A Call to Action, which spells out a vision of science education that will make scientific literacy for all a reality in the 21st century (1996).

The Trends in International Mathematics and Science Study (TIMSS), compares the mathematics and science achievement of students in the United States compared to students around the world. Every four years, the study is conducted for fourth and eighth grade students. In 2003, U.S. fourth-grade students exceeded the international average in science. No measurable changes were detected in the average science scores of U.S. fourth-graders between 1995 & 2003. The available data suggest that the performance of U.S. fourth-graders in science was lower in 2003 than in 1995 relative to the 14 other countries that participated in the studies. In 2003, U.S. eighth-graders exceeded the international average in science. U.S. eighth-graders outperformed their peers in 32 countries in science. U.S. eighth-graders improved their average science performances in 2003 compared to 1995. The data suggest that the performance of U.S. eighth-graders in science was higher in 2003 than it was

in 1995 relative to the 21 other countries that participated in the studies (TIMSS 2003).

The TIMSS data suggest that U.S. students must receive a stronger science education in order to improve their science literacy. Journal writing is one such method of building a student's literacy that I believe will enhance the scientific literacy of my students.

Writing in the classroom has been extensively researched. In my search for ways to improve my students' writing abilities, I have found that journal writing stands out as a means to reach my goal to improve their writing abilities while enhancing their understanding of the science content.

Harmelink, (1998) says in the Science Teacher, "Journals encourage students to reflect on the process of learning science, practice communication skills, and think creatively about current issues in the science community." She further states, "Journals provide feedback both on how effectively students are learning and how well teachers are teaching (p.38).

It is clear, that as teachers, we must develop ways to attract students to the science content areas. I could find no studies linking the effects of journal writing on the inquiry method of science learning.

In the next chapter I will show a review of literature that correlates science journal writing and the inquiry approach to science learning. Some of the research is done on upper level students, but most is on primary grades.

CHAPTER TWO: LITERATURE REVIEW

How does journal writing in science impact student learning? Research indicates that journal writing enables students to clarify and extend their knowledge in science content areas. Furthermore, journals establish an open line of communication between teachers and students, allowing for feedback and assessment. “Science journals are great for analyzing progress, connecting misconceptions, and solving problems- and if that’s not enough, students can also use them to answer their own questions” (Ajello, 2000 p.56). While allowing students to write in journals helps them from an analytical aspect, it also allows them to explore the scientific method in a documentable way. Shepardson and Britsch state that, within the use of science journals, “children state the purpose for their investigation, present their questions, make predictions based upon their prior ideas and understandings, and plan the investigation or explain its procedures” (1997, p.14). By allowing the children these opportunities to explore science through journal writing, students are being exposed to a constructivist teaching and learning approach (Hand, Prain, Lawrence and Yore, 1999, p. 1027).

This literature review resulted in the emergence of five themes that are relevant to my study: scientific literacy, written communication, assessment, questioning, and constructivist teaching. I have addressed each theme in this review of literature. Inquiry is the process scientists use to learn about the natural world. Although students rarely discover knowledge that is new to humankind, current research indicates that they engaged in inquiry discover knowledge new to themselves. Students approach inquiry in a many different ways, including making observations, posing questions, examining books and other sources of information to see what is already known, planning investigations, reviewing what is already known in light of the student's experimental evidence, using tools to gather, analyze and interpret data, proposing answers, explanation, and predictions, and communicating the results.

Inquiry requires the use of assumptions, use of critical and logical thinking, and consideration of alternative explanations. As a result of participating in inquiries, students increase their understanding of the science subject matter investigated, gain an understanding of how scientists study the natural world, develop the ability to conduct investigations, and develop the habits of mind associated with science (CS3/NASA/NLIST Initiative 1999-2004).

Scientific Literacy

Literacy is the main goal in educating young children. Reading, writing, speaking, and listening comprise a majority of the school day in primary classrooms. The literacy instruction in primary grades focuses on learning to read. As children reach the intermediate grades, the focus shifts from learning to read, to reading to learn. Dickinson and Young (1998) believe that the main goal in any elementary school classroom is to produce literate readers and writers.

Goodnough (2001) indicates that scientific literacy requires students to gain not only an understanding of the theoretical and conceptual principle of science, but also to develop an understanding of the nature of science. One strategy that teachers may use to gain insight into children's thinking is the use of journals. Shepardson and Britsch (1997) stated that, "written reflection is essential to promote children's explorations of their own thinking and learning process" (p.15).

Hand et al. (1999) gives a teaching example of a unit made for eleventh grade science students wherein three writing tasks were designed for the unit: a newspaper article, a concept map and a report to peers, each of which could help produce literate readers and writers. The unit helped teachers determine how writing in the science classroom could promote science literacy,

rather than be used just as a process for recording information. Hand et al. (1999) indicate that teachers need to incorporate a series of different writing types for different purposes and different audiences. “The different tasks were chosen to provide a variation in audience and different contexts for writing that reflected the broadened dissemination and persuasion requirements of science literacy (Hand et al., 1999, p.1030). This study identified areas for additional classroom-based research on the role of writing to enhance science literacy. The need to identify the most effective tasks for promoting certain skills will help teachers’ better plan writing instruction, instead of just having students write for evaluation purposes.

Chidsey (1996) found that “writing in science during the elementary school years has generally been used for evaluation and review purposes but not for emphasizing knowledge construction and critical thinking”(p.6). Journals provide students with many opportunities to develop scientific literacy. As students’ scientific literacy grows, so should their scientific communicative skills. “Journals are important. Through them, we, as teachers, accomplish several goals: We engage students in reflective thinking, provide authentic writing experiences that develop fluency and offer opportunities for growth as inquirers” (Manning and Manning, 1996, p.107). In

the next section, the communications between students' journal writing and the teachers' insight into what has been learned will be discussed.

Communication

Quality written communication, in science, is an essential component for students in order to facilitate comprehension. Teachers can gain insight into children's thinking and attitudes towards science concepts being taught. "Deep understanding occurs when the presence of new information prompts the emergence or enhancement of cognitive structures that enable us to rethink our prior ideas" (Brooks and Brooks, 1993, p.15). Research shows that communicating effectively in science deepens students' understanding. Harmelink (1998) wrote:

> Writing naturally leads to better learning because it is a constructive, reflective process. As students write, they may discover which science concepts are especially confusing to them. They can then develop their understanding of these concepts by linking them to concrete examples in everyday life. Writing also helps students practice communication skills. Because a large part of the scientific process involves communication, students need to

become better communicators. What good is a scientific idea or invention if it is not shared with others? (p.36)

Communication is a key element within the scientific process. Shepardson and Britsch (1997) found that, “Children use information written and drawn in journals to communicate or share the investigation with others, and also apply findings to the everyday” (p. 14). Through the use of science journals as a communication tool, children can create books, posters, songs, poetry, and stories to share with teachers and peers. “By creating a presentation, poster, or other work, children are engaged in exploring narrative and in synthesizing and applying their new understandings to a new context” (Shepardson and Britsch, 1997, p. 15). Pearce (1999) comments that all children have stories about their investigations that they desire to share, and that they are enthusiastic about reporting their findings. In the primary classroom, communication alternatives, such as the ones offered by Shepardson and Britsch, other than the formal written report may be more developmentally appropriate.

Teachers can communicate with their students by responding to their journals in writing. “Carrying on a dialogue with students in their journals is time consuming, but it’s well worth the effort” (Manning and Manning, 1996, p.107). Teachers

have an obligation to guide their students' learning. One effective way to accomplish this is to "provide children with opportunities to decide what is salient from the scientist's point of view. This means developing new ways of seeing (science) … and the representation of children's understanding on the journal page" (Shepardson and Britsch, 2000, p. 33).

Students can clarify their learning by responding to their peers in each other's journals. They can write a comment or question to extend the concepts being taught. Brooks and Brooks (1993, p.60) stated, "Students' points of view are windows into their reasoning." Teachers need to nourish their students thinking by giving the opportunity to investigate science concepts, make discoveries, as well as mistakes. This is an example of Dewey's philosophy, "We learn by doing!" (Palermo, 1992). National Science Education Standards indicate that the educator's analysis of students' journals give the teacher a knowledge base for decision-making "that build from experience, culture, and prior understandings" (NRC, 1996, p.42).

Klein (2002) researched the cognitive process through which writing can contribute to learning. His study included 70 students in grades 4, 6, and 8. The students conducted science experiments on either buoyancy or the balance beam, stated their explanations of the phenomena, and then wrote journal-style

notes while thinking aloud. Four aspects of the data were analyzed: writing operations, transitional sequences among writing operations, text features, and strategies for generating content. “It was concluded that for elementary students, writing-to-learn depends on strategies that are diverse, local in scope, independent of one another, and moderate in sophistication” (Klein, 2002, p.317). He concludes by stating, “Educationally, these results suggest that learning through writing could be an appropriate activity for elementary school students…” (p.344).

Levine and Geldman-Caspar (1997) describe writing-to-learn in the science context as a tool for both enabling students to develop an understanding of science, as well as a means of improving thinking and communication skills (p.360). They stated that:

> The writing-to-learn approach in science has two objectives: to encourage a shift in the focus of science learning and to alter the perception of writing from a vehicle of “knowledge telling” to a medium for the expression of innovative and interesting ideas… (Levine & Geldman-Caspar, 1997, p.361).

Therefore, journals provide students with opportunities to share their ideas effectively and creatively. Students learn how

to communicate through writing their ideas and thoughts. Journals can also serve to provide students and teachers with feedback and assessment opportunities. "… if you cannot in the long run tell everyone what you have been doing, your doing has been worthless" (Levine & Geldman-Caspar, 1997, p.360). In the next section, feedback and assessment will be addressed as it relates to children's comprehension of science through journal writing.

Feedback and Assessment

Teachers can analyze children's understandings as well as their misunderstandings from their journal writing. "Journals provide feedback both on how effectively students are learning and how well teachers are teaching" (Harmelink, 1998, p. 38). Shepardson and Britsch argue,

> The purpose of assessing attitudes in children's journals is not to reward the expression of positive attitudes or penalize the expression of negative attitudes, but to reward children for representing their feelings and attitudes about the science experience through journal writing (1997, p.17).

Rather, teachers can assess their students' journals by their interest, curiosity, and cooperation. "These journals enable teachers to assess the domains of conceptual

understanding, factual and procedural knowledge, scientific processes and attitudes" (Shepardson and Britsch, 1997, p. 15).

The use of journals in the science curriculum facilitates feedback. Harmelink (1998), Brooks and Brooks (1993), and Ajello (2000) each addressed the topic of feedback, and they all agree that by analyzing students' writing both the teacher and the student will benefit. "One vital ingredient of a successful journal program is the feedback you provide" (Ajello, 2000, p. 57). This is another way that teachers can gain insight into children's thinking and attitudes towards science concepts that are being taught.

In a program called Write Now, it is recommended that children write in their journals first thing in the morning for a few minutes every day. Manning and Manning (1996, p.107) discuss that this "writing to learn" technique ensures that students are on task as soon as they enter the classroom. Students respond in their science journals to content-related questions. Teachers are also able to monitor the children's progress and comprehension of the concepts being taught on a regular basis. "Journal writing benefits students by increasing their writing skills, articulation abilities and knowledge of mathematics and science" (Manning and Manning, 1996, p.108). They also state that Write Now "benefits teachers by improving

classroom management and helping with the monitoring of the overall comprehension of the students" (1996, p.107). If a teacher reads in multiple students' journals, that a concept was not clearly understood, then the teacher can attempt to reteach the lesson using a different approach (Manning and Manning, 1996).

Questioning

Young students constantly ask questions. Primary age students typically expect their teachers to answer their questions. Students and teachers engage in question and answer sessions on a daily basis. The traditional way of teaching was for the teacher to ask questions and for students to simply raise their hand to answer. Today, many students and teachers are engaged in discussions and research prompted by questions posed by student inquiry. "The most interesting, and potentially most useful form of student questions are the questions that come from creative engagement with the content of the lesson being taught"(Rop, 2002, p.718).

Inquiry learning in science focuses on students developing and asking questions for investigation. However, before a student can ask a question, regardless if the question is a research question or a testable question, the student must have some prior knowledge of the subject. Students acquire their

prior knowledge from life experiences, discussions, and books. “Before any question can be asked, some degree of basic knowledge must be present” (Pierce, 1999, p.16). The students’ prior knowledge aids student development, thoughtful research and testable questions.

There are two types of questions noted by Pearce (1999) research questions and testable questions. He pointed out that research questions are the questions that are most often asked in school. Testable questions are those that students can answer on their own either through direct observation or by manipulating variables in an experimental setting. Science inquiry opens the doors that invite both types of questioning.

The National Research Council (NRC) for science education (1996) stated that teachers should strive to create a positive questioning atmosphere within their classrooms. Students need time to develop their questions, time to research, and time to reflect upon the investigation process. This type of atmosphere will encourage effective questioning. According to the NRC, “Inquiry into authentic questions generated from student experiences is the central strategy for teaching science” (p.31).

A study done by Rop (2002), explored high school chemistry teachers’ perspectives on student inquiry questions that were

thoughtful, content related, and curiosity driven. This research study provides an exploration of a teacher's reflective process and decision-making approach regarding student questions. Asking questions is an important aspect of inquiry teaching. "If a teacher misses the opportunity of encouraging a student's inquiry question, an important teaching moment may be lost forever" (Rop, 2002, p.718).

One barrier to using inquiry noted in the research is that teachers feel pressure to cover too much content. The process of encouraging and guiding students to investigate their individual questions takes away time for teacher instruction. Furthermore, when teaching using science inquiry there is quite often not enough time to cover all the required topics in the curriculum. This seems to be the dilemma teachers' face in implementing inquiry. Rop, (2002) suggests that teachers evaluate which concepts awaken student curiosity, and which concepts encourage mindless algorithmic school work that has little connection to student interest or a sense of authentic inquiry. Student's inquiry questions, when related closely to the lesson content objectives, served as indications of interest in the subject matter and of a desire and capacity to learn (Rop, 2002, p.732).

Constructivism

Constructing one's own understandings is the basis of the theoretical framework of constructivism. According to constructivism, children create and develop their own ideas. "Deep understanding occurs when the presence of new information prompts the emergence or enhancement of cognitive structures that enable us to rethink our prior ideas" (Brooks and Brooks, 1993, p.15). Brooks and Brooks (1993) also argued that constructivist teaching practices help learners to internalize and reshape, or transform, new information.

Although Jean Piaget was not an educator, he is considered a leader in the development of constructivism. "In the constructivist approach, we look not for what students can repeat, but for what they can generate, demonstrate, and exhibit" (Brooks and Brooks, 1993, p.16). According to Piaget, learning is not merely memorizing knowledge. Students need to express their understanding of new information and concepts through their actions and writing. Constructivism is a theory about how we learn and focuses on in-depth understanding.

There is nothing paradoxical in this form of learning, nor does it require a mystical explanation. What it does require is an active mind that is able to reflect upon what it perceives

and upon its own operations. There is no doubt that we have such minds (Glasserfeld, n.d., p.9).

Prior to Piaget's findings, John Dewey was an educational pioneer and ahead of his time. Clearly, Dewey believed that students created their own meanings.

> Learning is the result of experience and that the only way students learn is by tying new information to existing knowledge. He believed that teachers should teach students how to become problem-solvers by helping them to learn how to think rather than simply learning rote lessons about large amounts of information (Ramos, 1999, p.4).

Dewey objected to the content and method of traditional teachings because it did not involve problem solving or reflective thinking. Marlowe & Page (1998) state "instead students memorized and recited unrelated chunks of material and became docile" (p.14). Dewey constantly argued that teachers were concerned mainly with students being able to recite material without error.

In other words, students should be able to solve problems that deal with the world around them through the learning process. Learning is not just regurgitation of information. "The main proposition of constructivism is that learning means constructing, creating, inventing, and developing our own

knowledge" (Marlowe & Page, 1998, p.10). Through the use of journal writing and constructivism, students learning processes should become more closely aligned with Piaget's idea of learning.

Summary

In conclusion, research indicates the advantages of integrating journal writing into science curriculum. The five themes presented from reviewing the literature surrounding this study reinforce science learning. In order to be scientifically literate, an individual must be able to communicate the investigative process, which is sparked by his or her own questions generated on the basis of personal experience. "When kids engage in investigations based on their own questions, they have stories to tell and discoveries to share" (Pearce, 1999, p.19). The important thing is, ultimately, to produce a scientifically literate society by engaging students in inquiry-based learning which allows them to reflect on personal experience, ask questions, and communicate effectively.

Journal writing can be used in several different ways. Students can use their science journals to draw on prior knowledge, make predictions, record observations and collect data, draw conclusions, and reflect on what was learned.

Teachers and students can use the journals to provide feedback during and after the writing process. Harmelink states that:

> Journals are a great addition to any science classroom. They provide opportunities for students to communicate with us, to make better connections between science concepts, and to think critically. Journal writing gives students a chance to be creative and imaginative, and evaluating student journals also helps teachers ensure that their students are truly learning (1998, p. 38).

There is a wealth of research done on the use of journal writing in the classroom and an even larger collection of science inquiry learning. In the next chapter I will describe the action research study I conducted that correlates the two.

CHAPTER THREE: METHODOLOGY

Introduction

The purpose of my study was to examine the effects of my teaching practices associated with science journals on my second grade students' science literacy and attitudes, as well as their ability to perform scientific inquiry. Introducing students to science inquiry was a learning strategy that I wanted to implement in my classroom. My students were full of questions and I wanted to foster that eagerness to learn. I felt that the combination of science inquiry and journal writing would offer rich learning experiences for my students.

Design of the Study

My study was a naturalistic action research study of my classroom practice. This was an action research study focusing on student attitudes and performance related to student journal writing and my science instruction. Naturalistic research studies the behaviors of the teachers and students as they occur, without control or manipulation (Gay and Airasian 2003 p.205). A mixed methods approach, both qualitative and quantitative, was utilized in this study. Qualitative research uses narrative, descriptive, approaches to understand the

phenomenon in a particular setting. Whereas quantitative research utilizes empirical data in order to understand and analyze information. This was an action research study focusing on attitudes and performance on science instruction. Action research “creates opportunities for all involved to improve the lives of children and learn about the craft of teaching” (Mills, 2003). Action research assists teachers in finding out what works and does not work in their classroom. The results gained from this action research study will help me make decisions about my own practices directly influencing students’ attitudes toward science and their learning of science.

Gay and Airasian(2003) define qualitative analysis as “the non-numerical examination and interpretation of observations, for the purpose of discovering underlying meanings and patterns of relationships” (p.221). The design of this action research study utilized both qualitative and quantitative techniques. This action research is mostly qualitative in nature. Most of the date was qualitative in nature because qualitative data exposes the researcher to a deeper meaning than numerical or quantified data (Mills, 2003).

Setting

The setting for this study was a second grade classroom in an urban kindergarten through fifth grade elementary school

located in Central Florida. The school is a magnet school for mathematics, science, and technology. Students are bussed to school from across the entire county. Student population is 750 students, 105 of which are second graders. There are 32 classroom teachers and 11 resource teachers. Sixty-two percent of the students participate in the free or reduced lunch program. The school offers a variety of programs to meet the individual needs of students. Specific Learning Disabilities (SLD), Emotionally Mentally Handicapped (EMH), Emotionally Handicapped (EH), and English as a Second Language (ESOL) programs are offered at every grade level.

Participants

The second grade class, assigned to me, consisted of 20 children at the beginning of the study. One child moved to another school in the early part of the school year. One parent preferred for her child not to be included in the study. Hence, the study group consisted of 18 mixed ability students, 10 boys and 8 girls. Of those 18 students, there were 8 African Americans, 4 Hispanics, 2 Asians, and 4 Caucasians. Two of the students are in the English as a Second Language program (ESOL). The ESOL teacher came into my classroom for one hour and fifteen minutes a day to work with her students within the classroom setting. Her students continued with my classroom assignments,

and she provided extra support for them during that time. This is known as ESOL inclusion.

During the fall semester, I had a senior intern assigned to my classroom from the University of Central Florida (UCF). Consequently, I had to spend some time modeling lessons for her. We also co-taught and collaborated on projects as she prepared to teach full time. In October, when this action research began, she was doing most of the classroom instruction, and I was observing and guiding. Time management was a difficult task for her to master; therefore students' journal entries during this time were often incomplete.

Procedures

After receiving Internal Review Board (IRB) approval (Appendix A), parental consent forms (Appendix B) were sent out to inform parents of the study. Sixteen out of seventeen of my students returned the consent forms with permission to participate in the study. The students then completed assent forms (Appendix C). With all of this documentation in place, data collection began.

In our mathematics, science, and technology school we have an integrated curriculum that focuses on our science strands. Each nine weeks, our content is focused on the different strands. During this data collection period, the students

studied the “Nature of Science”, “Nature of Matter”, “Forces and Motion and “Energy” strands. Science content is taught through integration in all subject areas. Prior to hands-on activities we read non-fiction books about the content of each strand and writing was incorporated whenever possible. The curriculum was designed to immerse students into science content through the use of the scientific processes by helping students to think critically and become problem solvers.

At the start of the 2004-2005 school year, I implemented science journals as a way for students to respond to the science content before, during, and after instruction. Writing was a daily activity in my classroom across the content areas. I encouraged written responses to many lessons and activities to give everyone a chance to respond. The students wrote about their thoughts, insights, and questions from an inquiry lesson. In these journals, students responded to several activities and investigations. When we did an activity, I had my students record data in their journals and draw conclusions about what they observed. Reading my students’ journal entries helped me to see if they had an understanding of the science content being taught. With this knowledge, I was able to plan further instruction and determine whether to move on to the next

concept, re-teach whole group, or pull a small group for clarification of the concept.

Throughout the data collection period, I taught mini-lessons on writing in which we discussed ways to improve their writing entries in the future. The class studied the use of access features within non-fiction books. For example, the students learned that captions for pictures and photographs are a useful access feature because it gives the reader more information about the topic. I taught several mini-lessons on how to write captions for their illustrations in their science journals. Many of the mini-lessons were focused on scientific vocabulary. I implemented a mathematics and science word wall in my classroom that was filled with all of the vocabulary that had been previously taught. I tried to encourage students to use these words within their journal writing.

Instruments

A major instrument used in this study was the student's science journals. Other instruments were attitude surveys, rubrics, field notes of teacher observations, transcripts of informal student interviews, and transcripts from video-recorded lessons. The next section, Methods of Data Collection, includes details about how the instruments were used in the study.

Methods of Data Collection

I conducted a mixed methods study to examine my teaching practice. I collected data on the effects of using science journals on my students' performance and attitudes in science. My students took an attitudinal survey at the beginning and end of my data collection period. Students wrote in their science journals before, during, or after each inquiry lesson. I wrote field notes of my observations and video recorded inquiry lessons and student interviews.

Direct observation from the teacher's perspective is a strategy in collecting data. Mills (2003) noted that as teachers we are constantly observing our environment and adjusting our teaching, so action research provides a systematic way to view this process as a qualitative data collection technique. Using observation and regular interaction with the students, I recorded weekly field notes as we explored science as inquiry. The science content explored during the study involved the strands of the nature of science, nature of matter, and energy. Since I only taught science three or four days during the week, field notes were not recorded daily.

Journal writing was a major form of data collection in this study on a weekly basis. Students recorded previous learning, ideas, questions, and new concepts in their science journals.

The journals were set up to guide the students through the scientific process. The journals were a space to record prior knowledge, predictions, and any question they might have. Mechanics of writing were not viewed as important skills in this type of writing as the focus was getting their thoughts on paper.

I utilized two main journal types in my study depending on the amount of time available, as well as the extent of the lesson taught. The first type was a five-minute journal. The goal of this type of journal writing was to quickly synthesize students' thoughts into a journal in order to promote future thought development on the subject. This was an ideal way to gather data in the last few minutes before another classroom activity. The other journal type I utilized was an exploratory journal. The goal for these journals was to gather thoughts from my students in a more structured manner. Students were given sufficient time to write more well thought out entries. These types of journal entries were ideal for the beginning and end of an experiment or lesson because they allowed the students to expound on a concept rather than furiously write about a single fact.

Attitudinal Survey

I was granted permission to utilize an attitudinal survey that had been used in prior study (Appendix D). I administered the survey at the beginning and end of my study, as part of my data collecting techniques to provide insight regarding students' feelings and attitudes toward science (Appendix E). The survey consisted of eleven questions about students' thoughts and opinions about science and its instruction. This attitudinal survey used a Likert Scale survey with three response choices: I loved it, I liked it sometimes, or I do not like it. I assigned a value of 0 to I do not like it, 1 to I like it sometimes, and 2 to I love it. The attitudinal questionnaire required the students to provide written explanations of their feelings and allowed for elaboration by asking why. The students answered these surveys in August when I began my study, and they completed it again in January at the end of my data collection period. Both attitudinal surveys were read aloud to the students to accommodate the student's varying ability levels. The responses were used in determining students' attitudes toward science.

Journal Rubric

Constructing a rubric suitable for my second graders science journals was not an easy task. I decided to implement a

simple rubric in order to score my students' entries. The rubric (Appendix G) rated their journals on a three point scale for assessing their daily entries, use of scientific language, application to the real world, concept understanding, and clarity. Level three was the highest score and level one was the lowest. I administered the rubric to several colleagues on my team for their input and in order increase validity. The rubric did not focus on handwriting or sentence structure, only science content. It was not shared with the students because it was not a part of their science grade. I was looking to see if my students could give reasonable predictions, develop possible explanations for a science phenomenon, and draw conclusions about the science lessons within their journal writing. I read the journals regularly throughout the data collection period.

Field Notes of Teacher Observations

Throughout the study, I observed students reactions towards journal writing assignments, their efforts, and the progress they made. I was an active participant observer, which means while I was teaching I was also observing the effects on the students in my classroom. Periodically I would record field notes of my observations. At the beginning of my study, it was my intent to record notes each day, but lack of time prevailed and I only wrote information on a weekly basis.

Video Recorded Lessons

Another method of data collection was video taping the students during science inquiry lessons. I wanted to capture the learning and discovery on camera to show how my students were working and what they discovered. Also, I recorded informal student interviews. Again, because of time restraints and availability of the schools' camera I only recorded twice per unit.

Assumptions

It was assumed that:

1. Students responded honestly to all questionnaires and surveys.
2. The data collection period, September 2004- January 2005, was sufficient time to observe student progress.
3. Students' interpretation of survey questions coincides with the researcher's intent.
4. Students perform at an optimum ability during journal writing.

Methods of Data Analysis

The purpose of this study was to answer three questions:

How will using science journals in the primary classroom affect students' inquiry skills?

How will using science journals affect the student's attitudes towards learning science?

How will using science journals enhance student scientific writing?

Determining answers to these questions required a variety of data analysis techniques. I read and reread all eighteen of the journals. I looked for common responses, errors, and responses to errors. I marked pages with sticky notes and colored tabs that corresponded to the varying responses. I thoroughly reviewed the notes from the video-recorded lessons and interviews, journal entries, students' attitude surveys, and the field notes in order to identify recurring themes in the data. I typed the data into a computer spreadsheet in order to organize it into themes and sub-themes.

This process allowed me to analyze students' words and work, and maintain credibility to my findings. My students were allowed to express any feeling or thoughts without regard to consequence in order not to unduly influence the findings. Hence, a triangulation across data sources provided the findings reflected in this study are documented. This also increased the integrity of the conclusions made. According to Mills (2003), "The process of interpretation is important because it can

challenge teacher researchers' taken-for-granted assumptions" (p.103). I had to make sure that my analysis was not influenced by what my expectations of what I wanted the results to be.

I made charts of the August and January results of the survey and questionnaire to show gains. Using these charts, I looked for trends in data. In addition, I created a chart of the students' two rubric scores. After rereading the transcripts from the video-recorded lessons several times, I coded similar themes using different colored sticky notes. I documented the common themes in the transcripts, and I assigned each theme a different color.

Summary

Collecting the data for my study was planned, carried out, and supported by research from studies and theories. Using research and studies from my own teaching experiences helped me prepare for my data collection methods. It also helped me structure my methods in order to effectively analyze my findings.

A variety of data collection strategies and tools were used to ensure the reliability of the study. A thorough examination of this data will be the focus of discussion in the next chapter, Data Analysis.

CHAPTER FOUR: DATA ANALYSIS

Introduction

Writing is a difficult task for my students, but it is an important element of the learning process. Using journals in science provided an avenue for integration of science and language arts skills. The data I collected, from my eighteen students, were guided by my research questions regarding the effects of journal writing on my second grade students' ability to learn science concepts and their attitudes. I utilized science journals, field notes, rubrics, attitudinal surveys, and video-recorded lessons for data collection. Entries in the students' journals and input from students through attitudinal surveys and questionnaires enabled me to look for emerging patterns and themes. I constructed charts from the surveys, science journals, and field notes to use as a visual display in representing data.

The following themes emerged from the analysis of the data:

1. Writing helped students to learn information and summarize their thoughts in regards to the science curriculum.

2. Students demonstrated positive attitudes toward researching in the science curriculum.
3. Utilizing student journals enabled me to teach my students science more effectively than at the beginning of the study.

In second grade, my students have already learned about the scientific method. Because of this, I was able to have my students use the scientific method during my study. Prior to the content being introduced, students were asked to write what they already knew and hypothesize as to what might occur during the lessons. They recorded data during investigations and lessons. Afterwards, the students drew conclusions and wrote in their science journals about their findings and experiences. Hence, journals were embedded throughout the entire learning process.

When I asked the students to write an entry in their science journals, I found many students were unable to synthesize their thoughts into their writing. When I asked them what they were doing, one common response was, “I’m thinking!” Scientific journal writing was quite a difficult task for my second graders. The students were being taught how to think about the information they were learning in order to document their learning. This was a fundamental shift for many of my students. They had been responsible for learning basic factual

information in their first two years of schooling, and now they had to utilize their knowledge and express what they had learned a science journal.

Writing to Learn in the Science Curriculum

One challenge in my classroom was keeping students motivated and interested in their assignments. Journal writing helped keep my students focused on their learning. Writing in science is an integral part of student concept cognition. By using science journals in the classroom, students are able to synthesize their thoughts into a usable media that can be analyzed and further developed in order to insure that lessons are being understood

In the beginning of this study, as the data show, sixteen out of eighteen students said they liked or loved writing in their science journals. In order to facilitate learning, it was paramount that my students enjoy what they were doing. In August, two students stated they did not like writing in journals, six stated they liked writing in journals sometimes, and ten stated that they loved writing in journals. In January, three students responded that they did not like writing in their journals, six liked it sometimes, and nine loved it. Nine students' attitude scores remained the same, while four

students' attitude scores increased and seven students' attitude scores decreased.

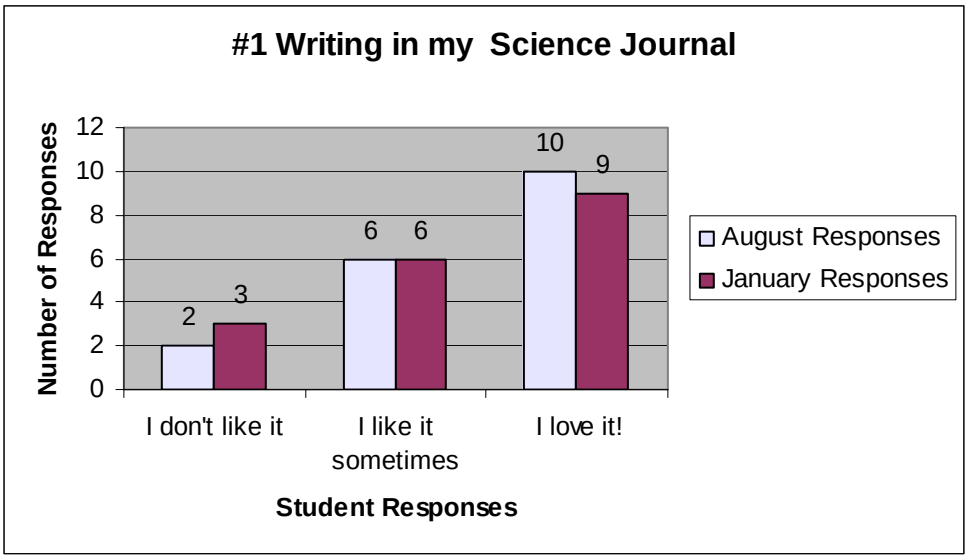

Figure 1: Survey Results for Student Science Questionnaire Question #1 "Writing in my science journal".

During recorded interviews, I asked a sample of my students why their answered changed from August to January, I received answers such as:

"It was harder than I thought it would be."

"This kind of journal writing makes my brain hurt."

"Writing is just writing your hipthisys [sic] (hypothesis), your obsefacon [sic] (observations), and your right answer".

It was clear from these responses that some of my students decided that journal writing in science was a more difficult task than they thought it would be.

I asked my students to respond to the following survey question: Does writing help you learn about science? The data show that my students were overwhelmingly declarative in their feelings that writing about science helped in learning science.

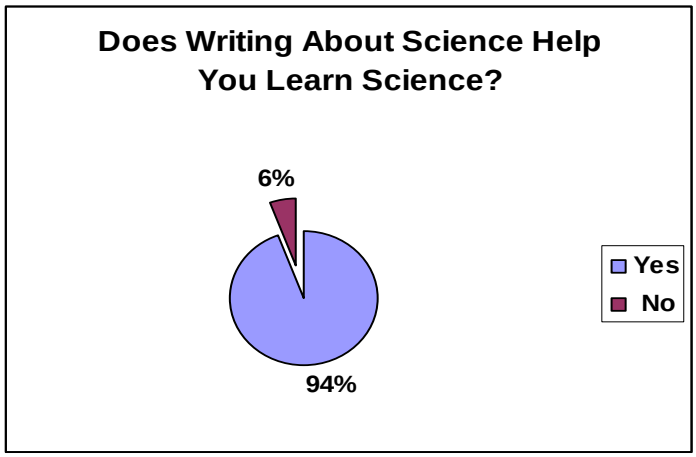

Figure 2: Survey Results for Student Science Questionnaire Question Twelve, "Does writing about science help you learn science?"

My students had different reasons why they thought writing helped them to learn science. Some of their responses to the open ended survey question were:

> "Yes. Because when I write about science it helps me undearstand [sic] science better".

> “Yes. Becuse [sic] writing helps your brain learn more science. Becuse [sic] writing helps me understad [sic] wut [sic] we are learning”.

Exploratory writing allows students to put their thoughts and questions onto paper. The use of exploratory writing was evident throughout their science journals and free writing. The science journal and free writing were used as strategies to allow students to write freely, without reservation, as the goal was writing to measure understanding. This data illustrated that my students were learning science students’ journals and allowed me to determine if a concept was being understood or if an idea was being missed.

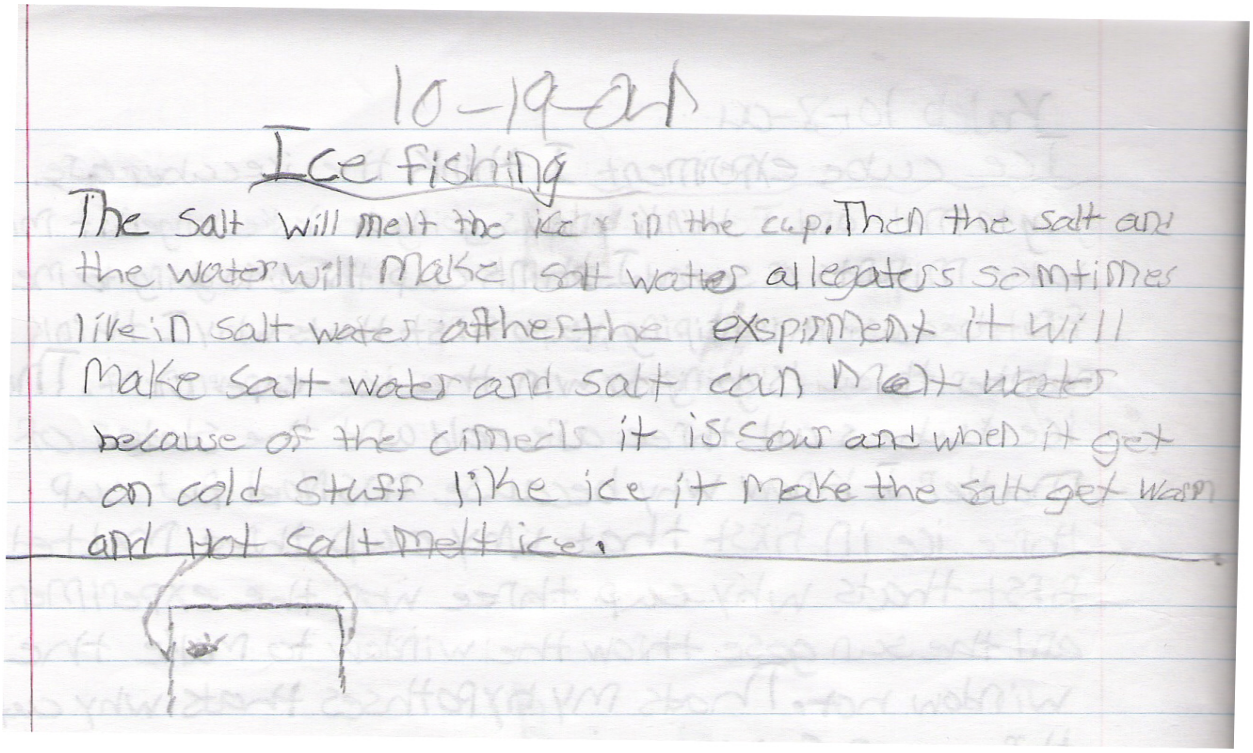

Figure 3: Exploratory Student Journal Entry

This student makes a good hypothesis, it is incorrect but I am able to see his reasoning behind it. This student did get a little off topic with the discussion of alligators, but this is expected on the second grade level.

Writing About Science Helped Students Learn Science

In an inquiry lesson about heat energy, my students were given a task, to make light using only one battery, a light bulb, and a stripped wire. My second graders were given no

further instructions. They were able to work with a partner or alone for this investigation. They formulated hypotheses prior to the lesson in their science journals. Next, my students tested their hypotheses by conducting the experiment several times. Some of my students achieved success, getting the light bulb to turn on after five or six tries, while others had to think about it and try again the next day. My students then wrote their conclusions in their science journals. They also wrote about the approach they took in order to achieve the correct results. This experiment was a success for all of my students. The data clearly show that my high achieving students were able to accomplish the goal of creating light energy, as well as my struggling students. All of my students were able to communicate their learning in their science journals.

The following is an example from one of my struggling second graders. This student was able to accomplish the same results as the rest of the class. By reading this entry, I was able to see that even this student was able to successfully perform the experiment.

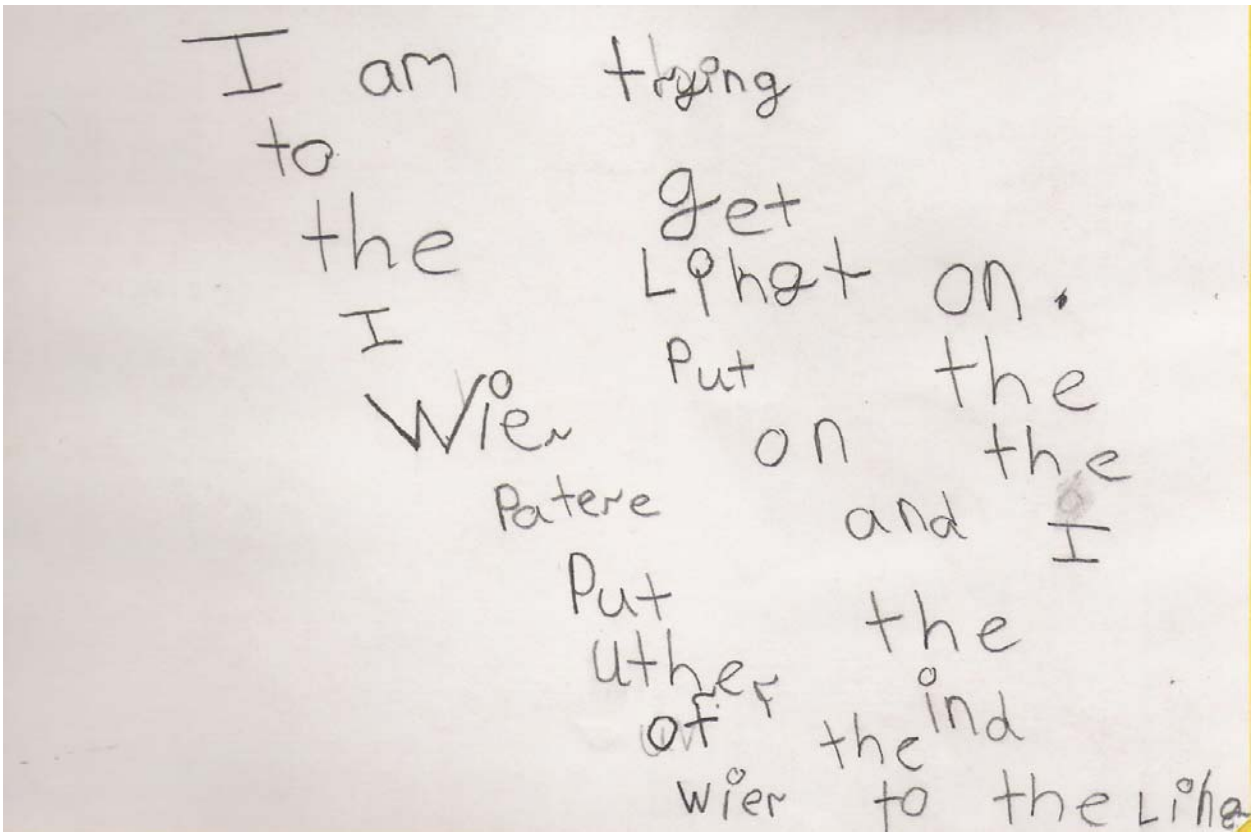

Figure 4: Analysis Student Journal Entry

Another inquiry lesson my students engaged in during the nature of matter strand, was “Ice Fishing”. The overall objective of this lesson was to compare the changing states of matter in water. The students were assigned the task of lifting an ice cube out of a cup of water using nothing but a piece of string and some salt. The only way to accomplish this was to sprinkle some salt on the ice cube while the string was laying on it. My students wrote hypotheses in their journals before the experiment and analyzed their data afterwards.

After analyzing the journal entries for this lesson, I was able to conclude that my students needed further explanations about the changing states of matter. If the journal entries had not been as obvious in their lack of full concept cognition, it may have been assumed that the students understood the entire lesson. I was also able to measure the students' concept cognition through the use of the rubrics that I developed for each lesson. My students were not scoring highly on the rubric. Their observations were correct, but they were not grasping the full understanding. I observed, in my field notes, that very few children were able to successfully complete the experiment in less than four tries. In a recorded informal interview with my whole class, my students expressed the same conclusions.

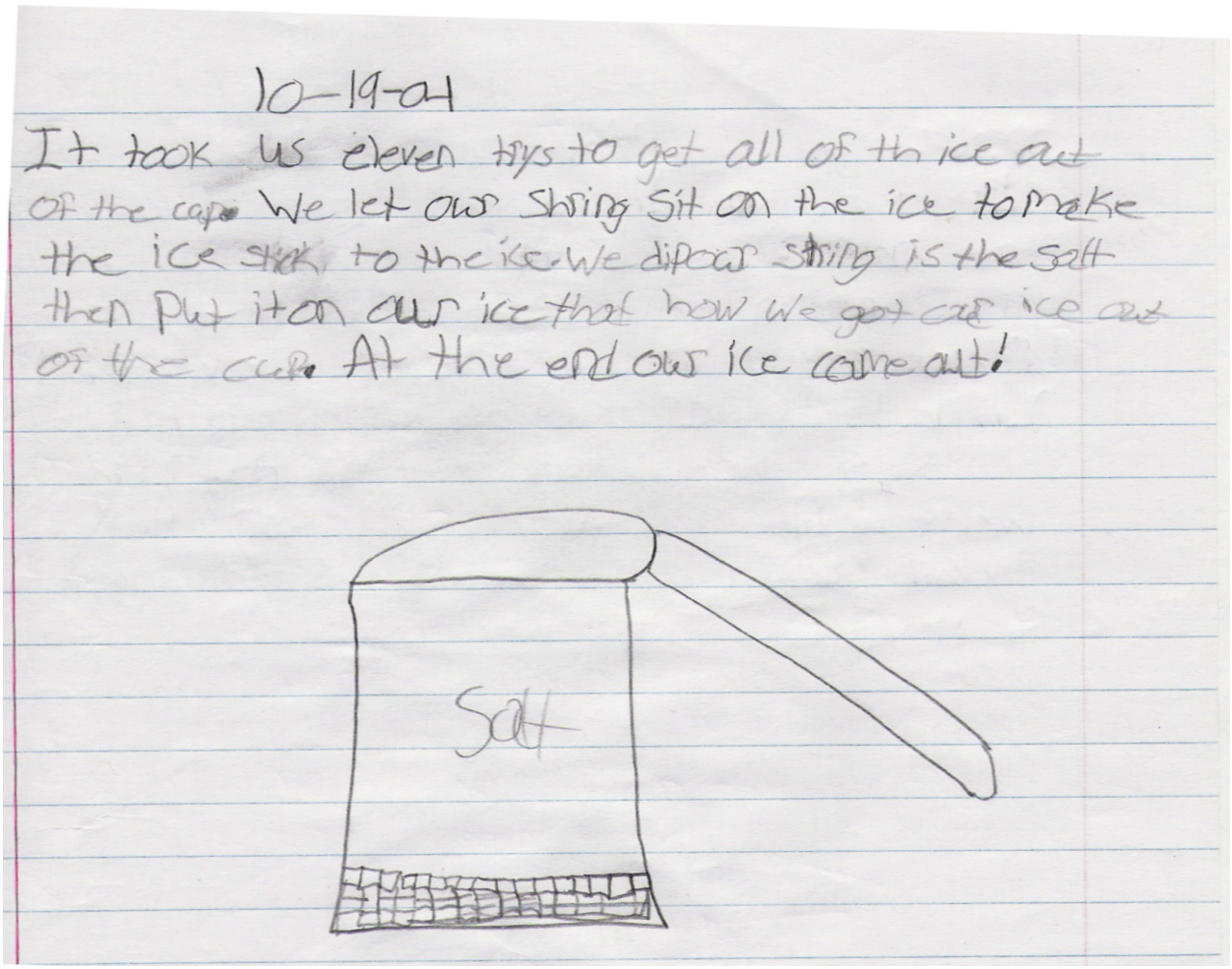

Figure 5: Analysis Student Journal Entry

This student was able to successfully remove the ice from the cup, albeit after eleven attempts. While the description was acceptable, there is definitely an opportunity to further explain the states of matter to this student.

When students write in their journals there are several different goals depending on what task is being undertaken. When the students are writing in response to a full lesson prompt,

the journals are detailed and can be read for concept cognition. Other times, the students are given a prompt to encourage a fast and furious response instead of a well thought out journal entry. The goal for these journal writings is to get the students' thoughts onto paper, usually at the end of a lesson, when there is not sufficient time to allow for full thought development before starting to write.

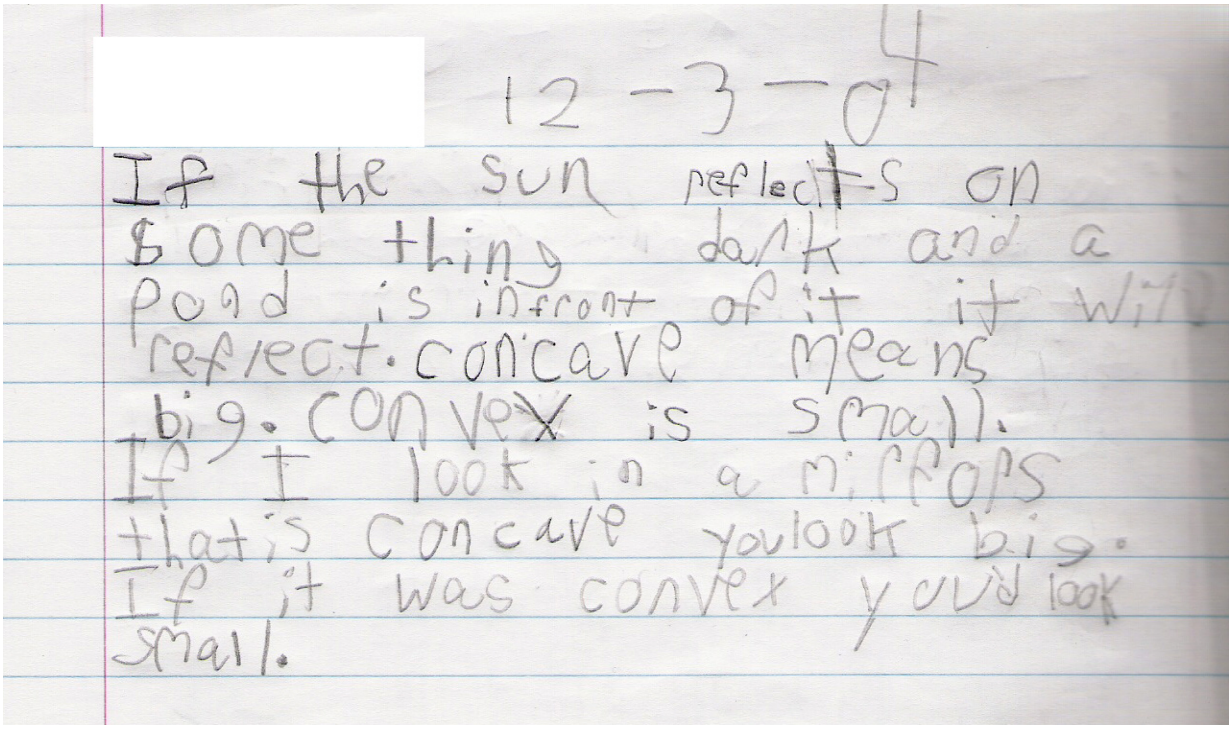

Figure 6: Five Minute Student Journal Entry

The journal entry in Figure 6 is a great example of a five minute journal entry. This student got right to the point about

the lesson. The language is concise and scientifically accurate. The data analysis illustrated that unfortunately, about one quarter of my students were unable to synthesize scientifically or linguistically worthy journal entries in a five minute span.

Conversely, Figure 7 shows an example of a student who wrote an ineffective entry. This entry was written about the prompt, “what is The Earth’s greatest source of heat”. This student did not express any scientifically or linguistically worthy information in the journal.

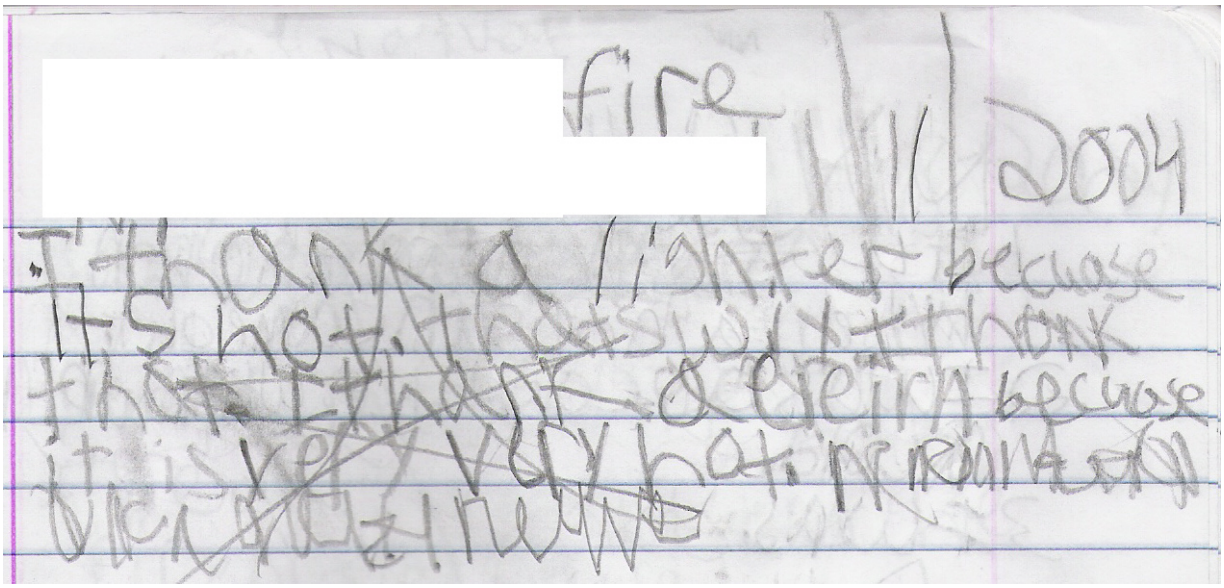

Figure 7: Five Minute Student Journal Entry

Students Demonstrated Positive Attitudes Toward Researching in the Science Curriculum

My students responded to the survey question: Do you like writing in your science journal? The data illustrate a positive shift in responses from August to January. In August, ten out of eighteen students responded with a positive answer, while eight students replied with a negative answer. By January, thirteen students had stated that they liked writing in their journals, while only five stated that they disliked it. As can be seen in the following chart, thirteen students have the same attitudinal response to the prompt in January as they had in August, one student had a negative attitudinal change, and four had positive attitudinal changes.

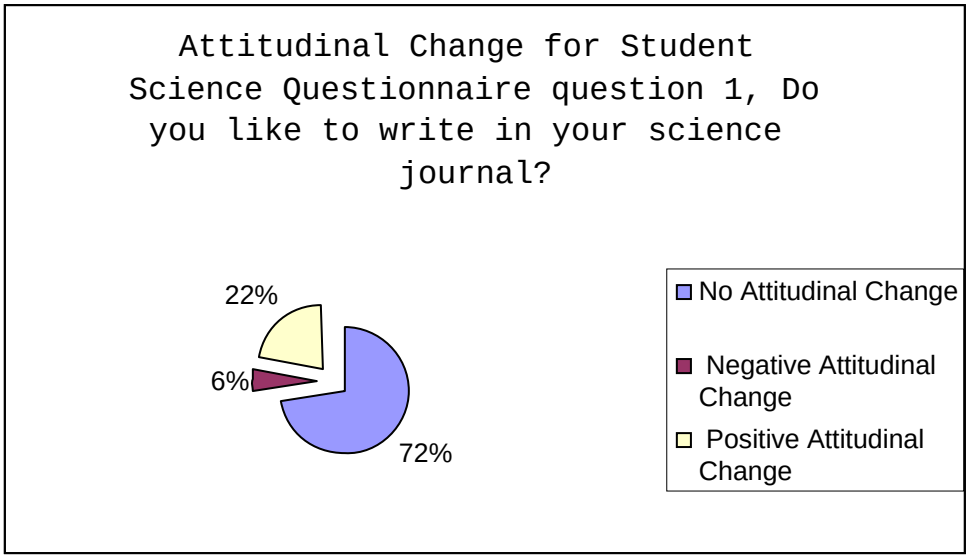

Figure 8: Students' Attitudinal Change for Student Science Questionnaire, Question One, Do you like to write in your science journal?

My students showed a change in attitude from August to January in several areas of my study. In response to question nine of the student survey, nine out of my eighteen students showed a positive attitudinal change in writing fast for five minutes. Six showed no change and only three showed a negative attitudinal change.

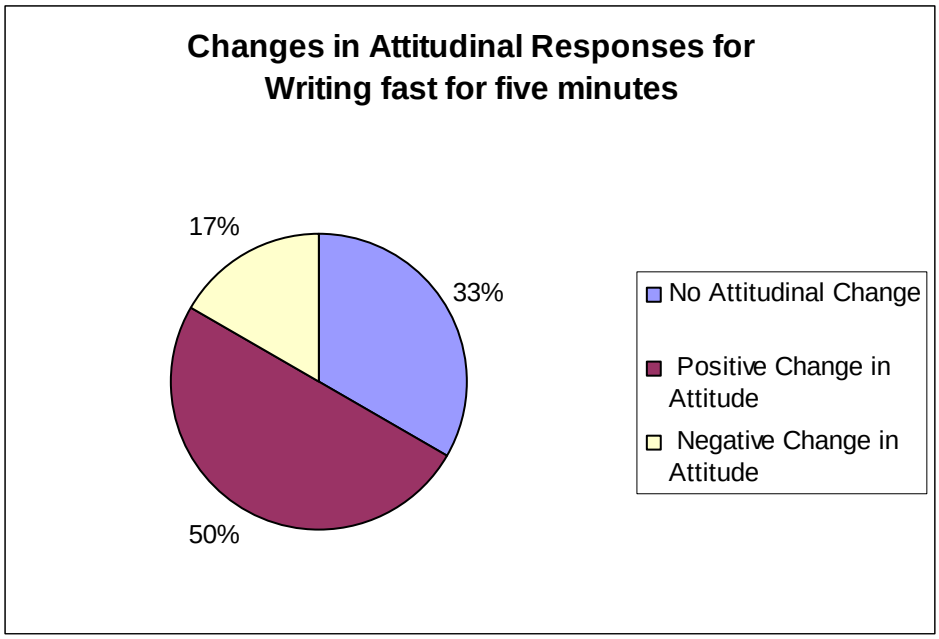

Figure 9: Students' Changes in Attitudinal Responses for Question Nine of the Attitude Survey

While observing my students in my classroom during the course of this study, the excitement and wonder was evident. Examined video taped data suggest that the second graders who participated in this study were eager to learn. Their eyes lit up with amazement during the matter experiment, ice fishing, when they figured out how to lift an ice cube out of a cup of water using a piece of string and salt. I was able to cull several quotes from the video tape of the ice fishing lesson. One student expounded, "The string gets stuck to the ice cube so I can pick it up"; another student told me that he was, "waiting for the string to stick to the ice because stuff sticks to ice".

Laughter and smiling faces were common during this experiment as well as the rest of my science lessons.

Students' Attitudes towards Writing

After the students wrote in their journals, we discussed what they had written. This discussion was captured on video. The students were able to make the connection that, "salt is something that helps ice to attach." We discussed how salt melts the ice and when it refreezes whatever is touching it sticks. My students were very excited to understand the concept and I was ecstatic when I read one student's journal entry after the discussion. This student made the leap from this experiment to a real life example, "I think that is why they put salt on the roads up where my Grammy lives, so the snow will melt".

Students responded to one of the attitude survey questions: What is science journal writing? In August, the typical answer was, "Journal writing is about writing about things"; or "Writing what is on the board." Their responses indicated that they associated science journal writing with school and writing what they were doing. By January, the typical responses had progressed to, "Journal writing is when you can tell all of the people what you did"; and "Journal writing is when you write your ideas about what you learned."

My students were asked if they liked writing in their science journals and why. In August, ten out of eighteen students had answered that they did. By January, that number had increased to thirteen.

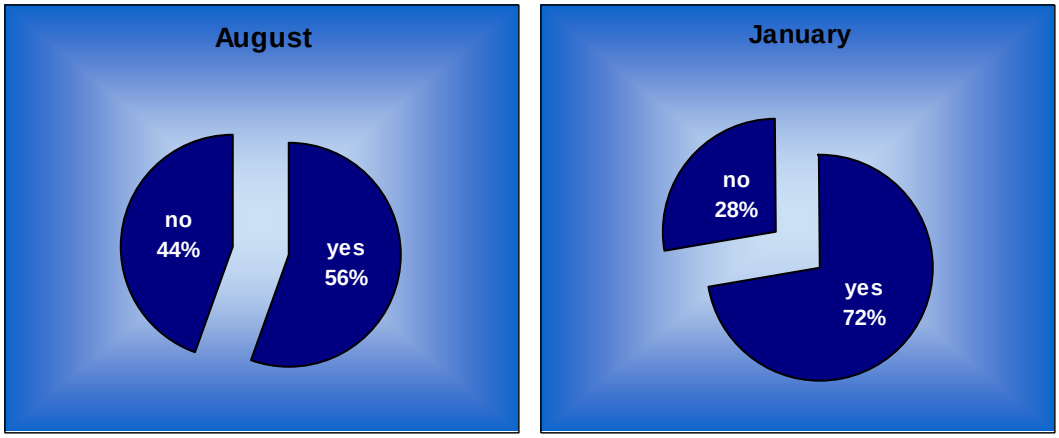

Figure 10: Response to Survey Question: Do you like to write in your journal?

The students responded to the question in different ways. One student wrote about the learning aspect of journal writing and one discussed the benefit of private thoughts between student and teacher.

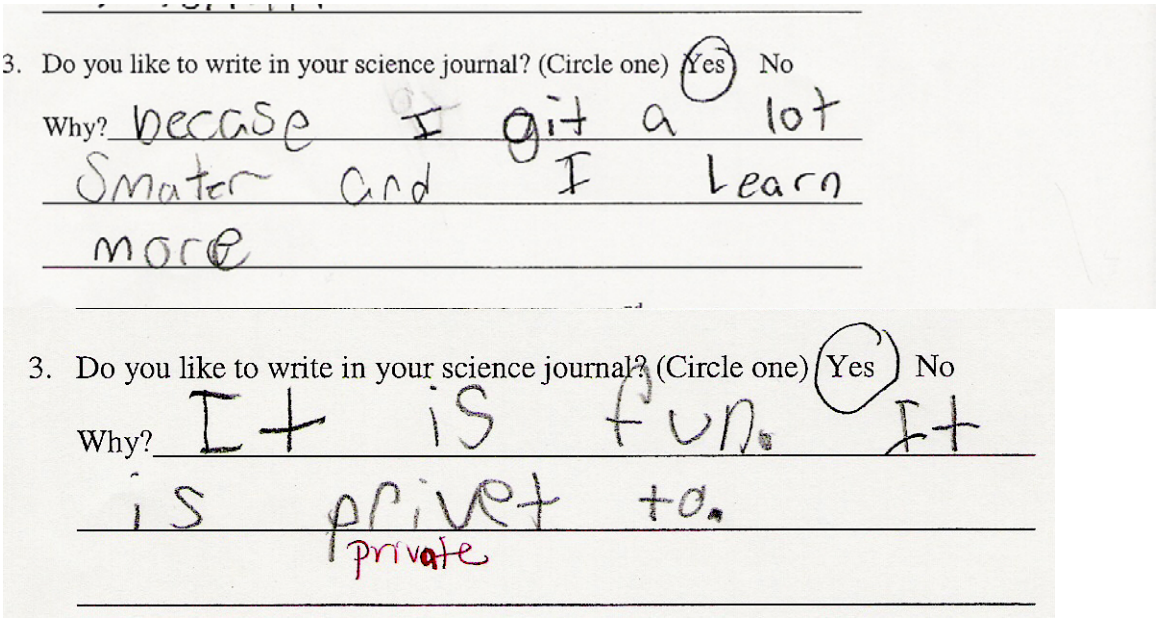

Figure 11: Student Responses: Do you like to write in your science journal?

Students' attitudes towards writing in science were reflected in the following quotes from the student questionnaire:

"Science journal writing is when you get to tell all of the people what you did!"

"I get to talk about fun experiments in my journal."

Being curious is a habit of mind that should be molded in science (Carin & Bass, 2001). As a teacher, I was also curious and interested about teaching science as inquiry. "Kindling, nurturing, and sustaining interest in science and technology is essential in contemporary science education" (Carin & Bass, 2001, p.34). My students responded to an attitude survey regarding curiosity and questioning. The data illustrate that,

the majority of my students expressed great curiosity and inquisitiveness about science. In the beginning of this study, all eighteen of the students stated that they either, loved being curious about science or liked being curious about science only sometimes. Eleven students “loved asking questions about science”; four “like asking questions only sometimes” and four “did not like asking questions about science”.

By the conclusion of this study, nine students stated they “loved being curious about science” and seven students “liked being curious about science only sometimes”, only two students stated that they “did not like” being curious about science. Sixteen students either loved or liked sometimes asking questions about science, two students did not like asking questions about science.

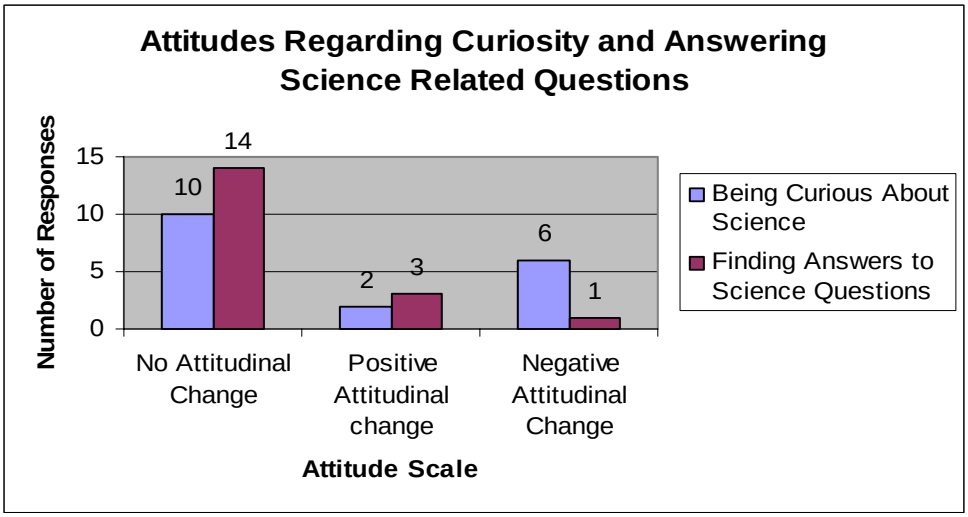

Figure 12: Response to Attitude Survey Questions Three and Six Regarding Curiosity and Answering Questions.

For my students, there was a divergent view when it came to being curious about science and answering science related questions. For the question regarding curiosity about science, ten students had no attitudinal change, two showed a positive change, and six showed a negative change. For the question regarding finding answers to science questions fourteen students had no attitudinal change, three showed a positive change, and only one student showed a negative change. In chapter five, I discussed my belief that my students were not, in fact, less curious about science, but they were no longer curious about the processes of researching science in my classroom after spending a full semester doing it.

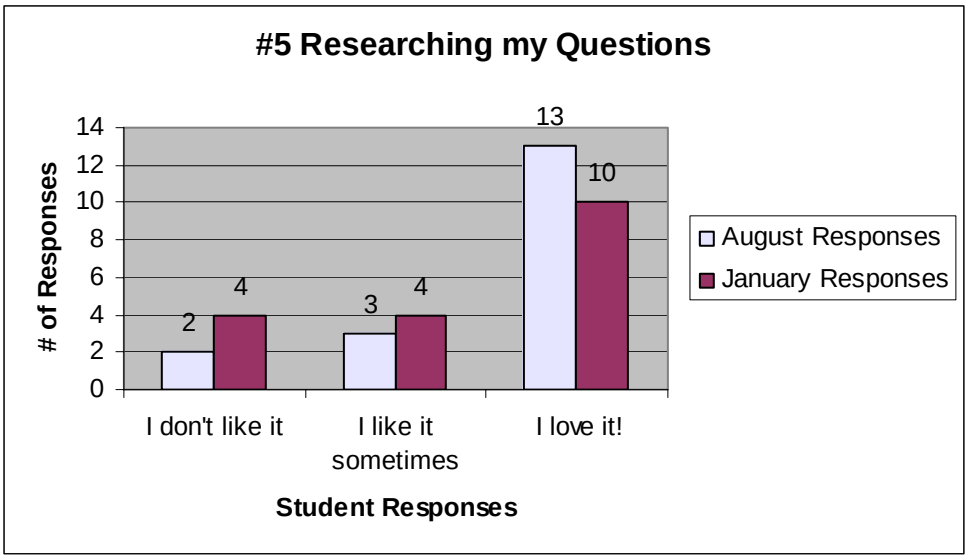

Figure 13: Attitudinal Responses from Survey Question Five

I asked my students to indicate how much they enjoyed researching the answers to science question in general. Thirteen of my students felt that they loved researching questions, three liked it sometimes, and two did not like researching. By January, the number of students that stated they loved researching questions had dropped to ten. There was an increase of one student in both the “I like it sometimes”, and the “I don’t like it” responses. In chapter five I discussed my belief that, my students were not enjoying research any less, just that having been exposed to the research methods, they had acclimated themselves to the process and were no longer as excited about the process.

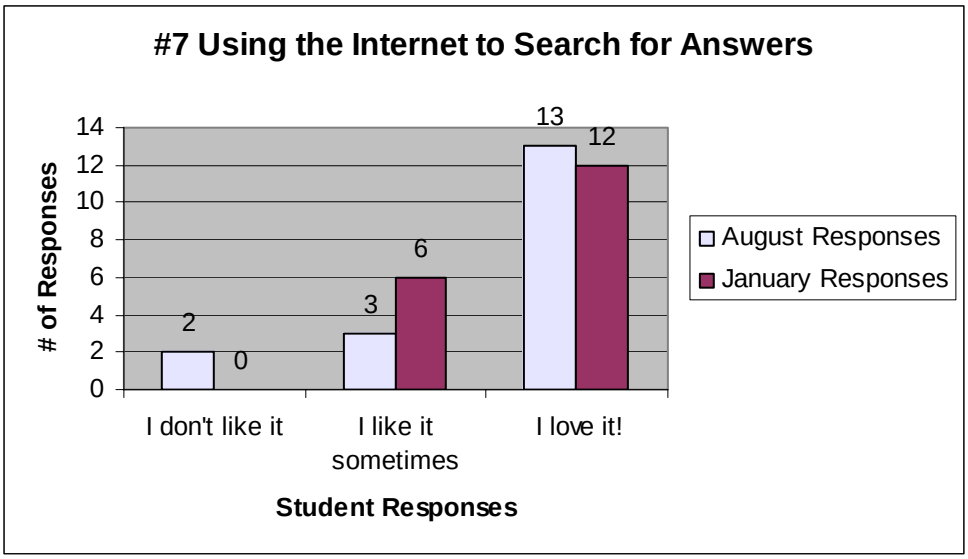

Figure 14: Attitudinal Responses from Survey Question Seven

I asked my students to how much they enjoyed researching the answers to science question using the internet. Thirteen of my students felt that they loved researching questions through the internet, three liked it sometimes, and two students did not like researching using the internet. By January, the number of students that stated they loved researching questions had dropped to twelve, but there was an increase to six students that liked it sometimes, and a decrease to zero students that did not like researching using the internet. This data support my belief that students enjoyed researching more after the fist semester.

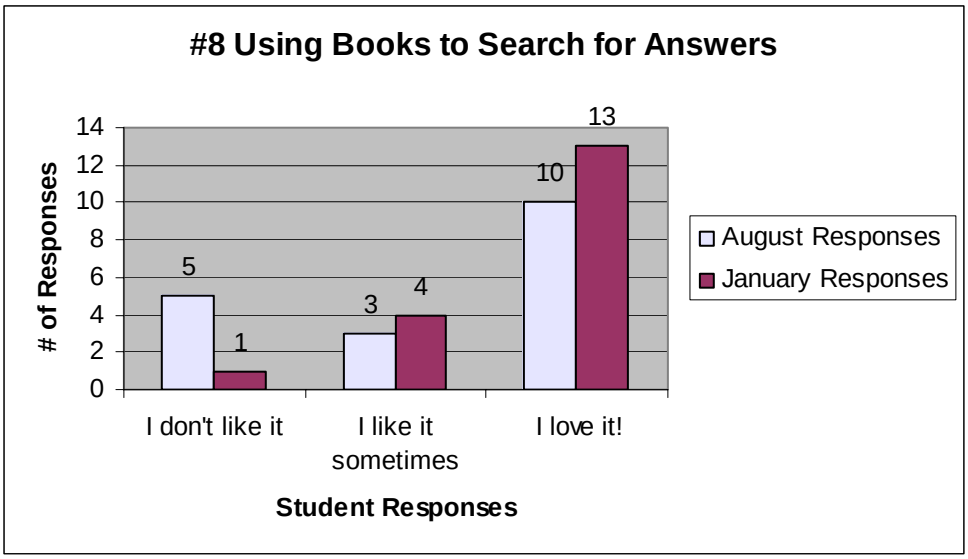

Figure 15: Attitudinal Responses for Survey Question Eight

I asked my students to how much they enjoyed researching the answers to science question using books. Ten of my students felt that they loved researching using books, three liked it sometimes, and five students did not like researching using this method. By January, the number of students that stated they loved researching questions had increased to thirteen, four students liked it sometimes, and only one student now stated they did not like researching using books. This data support my belief that students enjoyed researching more after the first semester. This data, the student interviews, my field notes and my observations triangulate my conclusions that my students had a positive attitude towards research.

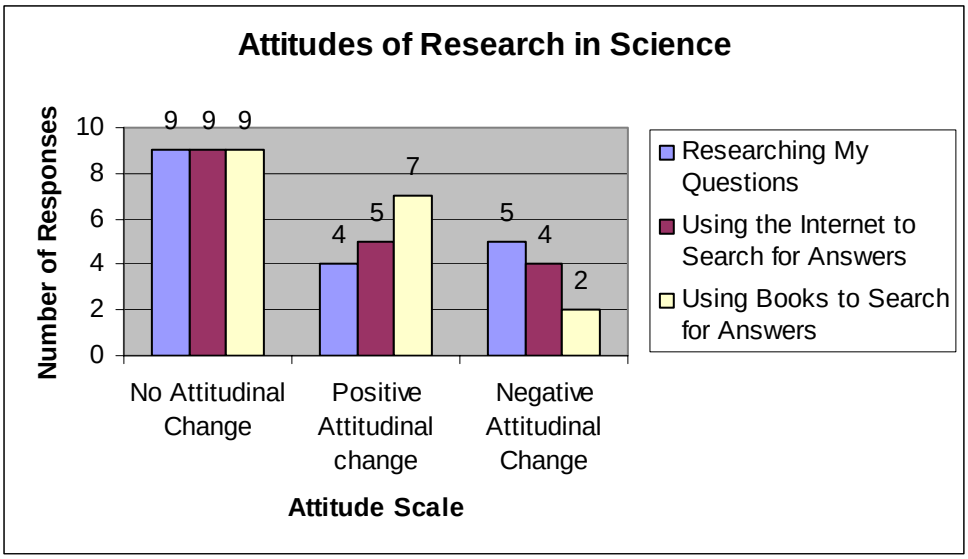

Figure 16: Attitudinal Changes From Questions Five, Seven, and Eight of the Student Survey

The preceding chart showed attitudinal changes for survey questions five, six, and eight. For all three questions, one half of the class did not express any change in attitudinal response. For question five, there was a slightly negative change in the overall population's attitude. Five students showed a negative change in attitude while four showed a positive change. I will discuss the significance of this survey question in chapter five. I feel that my students misinterpreted the question about enjoying research because they stated that they enjoyed researching using both the internet and books. For questions seven and eight, there was a positive increase in attitude.

Utilizing Student Journals to Teach More Effectively

Over the course of my study, I found myself relying on my students' journal writing as a tool to enhance my teaching. When I started the study I understood the benefits of journal writing for my students, but I was not expecting to experience such direct and powerful benefits to my teaching.

As I read through my field notes and watched the video sessions, I was able to conclude that I had increased my use of the journals. In addition to writing back and forth, in the journals, with my students, we began discussing what had been written in the journals and how that impacted the students' learning.

Prior to conducting the study, I was teaching science towards my students instead of teaching them about science. By that I mean, my students would sit in class and listen to the lesson I was teaching them, but they did not comprehend what I was teaching. They would try to write something in their journals (which may or may not have applied to the lesson). By reading the journals that my students used, I was able to see that I needed to change the way I was teaching science if I was going to impact their desire to learn science.

From the earliest grades, students should experience science in a form that engages them in the active

> construction of ideas and explanations and enhances their opportunities to develop the abilities of doing science. Teaching science as inquiry provides teachers with the opportunity to develop student abilities and to enrich student understanding of science (National Research Council, 1996, p.6).

After I started the study, I was better able to assess my students' needs for a change in the way the science curriculum was taught. The journal entries coupled with the rubrics and my field notes showed me which aspects of my teaching needed enhancement. By using these tools, I was able to positively change my teaching style to include more of an inquiry based method of teaching. The students' journal writing became much more effective.

Students' were able to write about the science lessons that we had covered. Using the rubrics, I was able to measure their cognition of each lesson as we progressed. For each journal entry I assessed: the overall entry, the use of scientific language, the application to the real world, and the concept understanding and clarity. Each category was scored on a scale from one to three, with the final score being from one to twelve. My students progressed from a median score of seven on their early journal entries, to a nine by the end of my study.

By utilizing the rubrics to supplement my own field notes, I was able to determine each student's comprehension so I could tailor further teaching to the class. Students were able to develop their scientific literacy by continually writing in their journals. Every student showed growth from the beginning of the study to the end. This proved to be a symbiotic relationship because as the students' journal writing showed me what they were missing in the way of comprehension; my lessons were able to be tailored towards those deficits.

Summary

The three themes concluded from the data analysis showed that: (a) writing helped students to learn information and summarize their thoughts in regards to the science curriculum; (b); students demonstrated positive attitudes toward researching in the science curriculum; (c) utilizing student journals helped me to teach more effectively.

Students were able to codify their learning through journal writing. As each lesson was taught and explained, students were able to draw conclusions, ask questions, and summarize their findings in their journals.

Students exhibited a positive attitude toward many aspects of science. They were extremely curious and eager to learn.

Having a positive attitude toward writing in science showed that the students were open to new ways of learning. The openness to new learning strategies allowed students to develop skills necessary to conduct research. This is a skill that will be used for years to come.

My own teaching was greatly enhanced by the students' journal writing. I was made aware of insufficiencies in my teaching that I was able to overcome because of the data I triangulated from journal entries, student interviews, and my own field notes.

In chapter five, I discussed the results of my study, conclusions that I drew, as well as recommendations for further research.

CHAPTER FIVE: CONCLUSIONS

Introduction

The purpose of this action research study was to examine the effects of my teaching practices associated with science journals on my second grade students' scientific literacy, their attitudes toward science, and their ability to perform scientific inquiry. As my study progressed I became aware of the changes in my teaching style and the tools I used, based on the information I obtained from my students' journal entries. I saw a natural curiosity in my second grade classroom, which was the foundation for implementing inquiry in my classroom.

Conclusions

This study involved eighteen second grade students who attended a mathematics and science magnet school in Central Florida. Based on the results of this study, I offered conclusions as they relate to the three research questions that guided this action research study.

My first question was: *How will using science journals in the primary classroom affect students' inquiry skills?* As defined by the National Research Council (NRC), scientific inquiry is a set of interrelated processes by which scientists

and students pose questions about the natural world and investigate phenomena (1996, p.214). Based on the results of student attitude survey questions three through eight (figures 13-17) my students were inclined to perform inquiry in the science curriculum.

I was interested to note that my students stated that they were less curious about learning science at the end of my study. My belief is that my students were not less curious about science as a whole. Rather, they were less curious about the methods and approaches that we used in our classroom. My data support this belief. In response to question number five from the student attitude survey, my students showed negative tendencies to overall research. However, there were strong positive tendencies to both question seven and question eight of the survey. These questions were in regards to methods of research, using the internet and using books, in order to obtain answers. During student interviews, I queried my students on their desires to research science in the future. One student responded, “Researching is fun cause *[sic]* I get to learn about all the stuff I have questions about”; another responded, “I want to do research so I can understand science more and get smarter.” My field notes indicated that my students were enjoying their research time. My students were always eager to

use books and the Internet to find new information in response to a question. Because of the triangulation achieved by this data, I can conclude that my students did in fact grow in their ability to use inquiry in the science curriculum.

My second research question was: *How will using science journals affect the students' attitudes towards learning science?* "Lifelong scientific literacy begins with attitudes and values established in the earliest years" (NRC, 1996, p.114). The data has shown that twenty-two percent of my students had an increase in positive attitudes towards science in regards to journal writing. "… students should be engaged in an inquiry approach to science that basically parallels the procedures scientists use and the attitudes they display in using science" (Carin & Bass, 1997, p. 15). Students were able to learn science while proceeding at their own pace. The use of journal writing allowed many of my students to achieve a sense of satisfaction. One student enjoyed it so much that she wrote, "I love to writ [*sic*] in my science journal, it helps me larn [*sic*] science more [*sic*] better". It can be concluded that writing in journals affects students' learning of science content. Both curiosity and openness to new ideas were noticeable attitudes among the students in this study.

The most surprising data I found were the change in attitude for question nine of my student attitude study, writing fast for five minutes. Fifty percent of my students showed a positive attitude change towards this prompt. No other data were as strong. My students were excited to write about what they learned and the five minute time limit gave them the opportunity to get down on paper what they were thinking without having the tediousness of a long journal entry. I believe that my students learned how to write more efficiently during the course of the study. Therefore, they were more excited to write for five minutes than they were towards any other writing assignment they were given.

The third question was: *How will using science journals enhance student scientific writing?*

Referring back to the definition of scientific literacy stated in chapter one: scientific literacy is defined as asking, finding, or determining answers to questions derived from curiosity about everyday experiences (National Research Council, 1996, p.23). As the data show, my students showed a slightly negative response to overall research. However, there was conflicting data shown by the two questions specific to research methods. In both of these questions, the students showed a distinct positive increase in their positive attitudes towards

research. It can be concluded that the students did not realize that research meant searching for answers. My students demonstrated their curiosity by asking questions, they used a newfound skill of conducting research, and engaged in writing for understanding of the science concepts. They also communicated their learning through writing. In order to achieve scientific literacy, students must be able to ask questions, communicate effectively, and reflect on personal experience. The students that participated in this study were engaged in all of these skills. Now that the students have begun using metacognition in their writing, I expect they will continue to think about what they are learning and grow from it. They will continue to research the questions that they compose during their journal writing. Although writing is still a difficult task for some of my students, I hope they will continue to write and grow as scientists in their continued education. I conclude that using science journals in my second grade classroom has enhanced students' scientific literacy as a result of this study.

Discussion

This was my first experience teaching inquiry. I was introduced to inquiry methods of teaching in my first year of the Lockheed-Martin/UCF Academy for Mathematics and Science

graduate program. I chose to study the effects of journal writing in an inquiry based science curriculum, as a way to measure my students' comprehension.

After conducting this action research on my teaching practice, I became more aware of the needs my students had with writing. I found that integrating science journals into the curriculum was a beneficial way to check for understanding and to give feedback to my students. As I read my students' journal entries and observed them during inquiry lessons and investigations, I could see who was truly learning and understanding, and who was merely leaning on another student for support.

By teaching using inquiry, I was able to meet the academic needs of all my students. Inquiry learning allows students to work at their own pace because they are formulating their own learning. As Pierce (1999) states, "In building the campfire, a match is the source of the flame. With inquiry science, questions spark the investigative process" (p. 12). Students can truly grasp whole concepts because they can ask anything questions about what they are learning instead of relying on lectures from teachers.

Inquiry learning is not just an educational trick; it is an ever changing system of learning and teaching between teachers

and students. No two lessons can ever be taught in exactly the same way because of this. I believe that facilitating inquiry in the classroom is the best way to teach. Instead of forcing teachers to conduct lessons by rote, inquiry teaching demands constant monitoring of their students. Teachers must be facilitators of discussions that will enable their class to grasp the material instead of just hearing the lesson.

> In teaching science through inquiry, teachers must make time to involve children actively in asking simple questions about the world, design investigations to collect data, reflect using investigative evidence and current knowledge in forming explanations, and communicating their investigations, explanations, and reasoning in multiple ways (Carin & Bass, 1997, p.38).

In order to make inquiry learning a success, students must be integrated into the lessons. If a teacher is not having a constant dialogue with the students, then inquiry learning cannot take place.

Recommendations

Recommendations for further study would be to collect data from older children who have had more experience with an inquiry based science curriculum. As students are exposed to inquiry learning, they begin to formulate different methods of engaging

science. It would be interesting to note the progression of a group of students through an entire education cycle i.e. kindergarten thru high school.

I also recommend that teachers should incorporate inquiry teaching into all aspects of education, not just science. I found that my students were inclined to learn more during inquiry based science lessons than they were during most other subjects we covered. They were the facilitators of their learning and I wish that I had incorporated more inquiry into the rest of my curriculum.

A third recommendation I would like to make is that the school systems as a whole needs to educate the teachers on how to use an inquiry based teaching method in their classrooms. Inquiry can be very beneficial to both students and teachers if it done correctly. However I caution all teachers, parents, and other educators not to get so caught up in a new method of teaching, that the students are forgotten. Inquiry must be guided by students needs. This final recommendation is critical if there is to be a paradigm shift in our educational system, inquiry can become the change agent that takes our students to a higher level of learning.

APPENDIX A

UCF IRB APPROVAL

University of Central Florida

Office of Research

June 25, 2004

Ms. Lauren Mia Enslein
Goldsboro Elementary Magnet School
1300 W. 20th Street
Sanford, FL 32771

Dear Ms. Enslein:

With reference to your protocol entitled, "Integrating journal writing with inquiry based science instruction in a second grade classroom," I am enclosing for your records the approved, expedited document of the UCFIRB Form you had submitted to our office.

Please be advised that this approval is given for one year. Should there be any addendums or administrative changes to the already approved protocol, they must also be submitted to the Board. Changes should not be initiated until written IRB approval is received. Adverse events should be reported to the IRB as they occur. Further, should there be a need to extend this protocol, a renewal form must be submitted for approval at least one month prior to the anniversary date of the most recent approval and is the responsibility of the investigator (UCF).

Should you have any questions, please do not hesitate to call me at 823-2901.

Please accept our best wishes for the success of your endeavors.

Cordially,

Barbara Ward

Barbara Ward, CIM
Institutional Review Board (IRB)

Copies: Dr. Nancy Lewis, College of Education
IRB File

12443 Research Parkway • Suite 207 • Orlando, FL 32826-3252 • 407-823-3778 • Fax 407-823-3299

APPENDIX B

PARENT CONSENT FORM

Parental Consent

August 2, 2004
Dear Parent/Guardian:

I am a graduate student at the University of Central Florida under the supervision of faculty member, Dr. Nancy Lewis, conducting research on integrating journal writing in the second grade science curriculum, and its effects on learning by the inquiry method. The purpose of this research is to study my use of the concepts and procedures of the inquiry method of learning. The results of this study will allow me to better serve your children as well as the students in the future. Students in the study will receive the same instruction as students who do not participate. The journal writing procedure will be part of the ordinary scheduled instruction by the teacher, and will be completed by all students. Entries will be made daily and for various purposes. The science journals are organized in such a way that enable a student to thoroughly think about a topic, relate it to prior knowledge, record new information, and ask questions. Only those journals written by students who choose to participate will be included in the study.

I will document my teaching using field notes, conducting informal audio taped interviews, and collecting the students' journal entries. With your permission, your child will be photographed and/or videotaped during the instructional period. The videos and photographs will be accessible only to the research team for verification purposes. The tapes will be for used for data gathering during interviews and lessons. I will transcribe the tapes in order to make the data more useable in my study. All of the tapes will be destroyed at the end of the study. Identity will be kept confidential to the extent provided by the law. All results will be reported as group data when possible. Participation or nonparticipation will not in any way affect your child's grade or placement in any programs.

You and your child have the right to withdraw consent for your child's participation at any time without consequence. There are no known risks to the participants. The potential benefits of participation will be a better grasp of the science curriculum and the scientific method. In addition, your child will, through the use of journals, be utilizing the written expression to communicate their learning. No compensation is offered for participation. Group results of this study will be available in June upon request. If you have any questions about this research project, please contact me at (407) 320-5846 or my faculty

supervisor, Dr. Nancy Lewis at (407) 823-4980. Questions or concerns about research participants' rights may be directed to the UCFIRB office, University of Central Florida Office of Research, Orlando Tech Center, 12443 Research Parkway, Suite 207, Orlando, FL 32826. The hours of operation are 8:00 am until 5:00 pm, Monday through Friday except on University of Central Florida official holidays. The phone number is (407) 823-2901.
Sincerely,
Lauren Zissman
I have read the procedure described above.

I voluntarily give my consent for my child, , to participate in Lauren Zissman’s study of using journals in science.

/

Parent/Guardian Date

I would like to receive a copy of the procedure description.

I would not like to receive a copy of the procedure description.

/

2nd Parent/Guardian Date
(or Witness if no 2nd Parent/Guardian)

APPENDIX C

STUDENT ASSENT FORM

Assent Form

My name is Lauren Zissman and I am a graduate student at the University of Central Florida. In our classroom, the use of science journals is an important part of our everyday learning experience. I would like to use your journal responses to collect information on how using a journal helps your writing skills and your understanding of science content. I would like to make a videotape of us working. You may stop writing at any time. Would you like to do this?

Yes, I would like to participate.

Signature_____

No, I would not like to participate.

Signature_____

APPENDIX D

PERMISSION FOR SURVEY USE

Subj: **Re: Lockheed Martin Master's Program**
Date: 3/6/2005 6:14:21 PM Eastern Standard Time
From: Angelacdunn
To: Landdwedding

I am granting Lauren Zissman permission to use part of my attitude survey from my Master's thesis.

Angela Dunn
407.230.2350

Angela Dunn

"You must be the change you wish to see in the world."
-Mahatma Gandhi

APPENDIX E

ATTITUDINAL SURVEY

Name Student Attitude Survey

Circle the number for how you feel.

0 = I don’t like it 1 = I like it sometimes 2 = I love it!

Writing in my science journal	0	1	2
Doing science experiments	0	1	2
Being curious about science	0	1	2
Asking questions about science	0	1	2
Researching my questions	0	1	2
Finding answers to my questions	0	1	2
Using the Internet to search for answers	0	1	2
Using books to search for answers	0	1	2
Writing fast for five minutes	0	1	2
Writing final copies	0	1	2

Do these activities help you learn science?

(Circle one) Yes No

Does writing in science help you learn science?

(Circle one) Yes No

APPENDIX F

STUDENT SURVEY QUESTIONNAIRE

Name_____

1. What is journal writing?

   _____

   _____

2. Do you think journal writing is easy or hard?

   (Circle one) Easy Hard

   Why?_____

   _____

3. Do you like to write in your science journal?

   (Circle one) Yes No

   Why?_____

   _____

4. Do you think Science is important for us to learn in 2nd grade?
   (Circle one) Yes No

5. Tell me one thing you really like about learning science.

   _____

   _____

6. Tell me one thing you don't like about learning science.

   _____

   _____

APPENDIX G

RUBRIC FOR STUDENT JOURNAL ENTRIES

Rubric for Journal Entries

	Sugar and Water	Ice Cube Melting	Ice Fishing	Energy
Assessing their daily entries	1,2,3	1,2,3	1,2,3	1,2,3
Use of scientific language	1,2,3	1,2,3	1,2,3	1,2,3
Application to the real world	1,2,3	1,2,3	1,2,3	1,2,3
Concept understanding and clarity	1,2,3	1,2,3	1,2,3	1,2,3
	Grand Total	out of 12		

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